The Mysore Agricultural Journal

(The Organ of the Mysore Agricultural and Experimental Union)

Vol. XXVII] July—September 1951 [No. 3

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IN THIS ISSUE

THE ANNUAL MEETING OF THE UNION, 1951

CULTIVATION OF CASSAVA AND PREPARATION OF ITS PRODUCTS

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The Mysore Agricultural Journal

(The Organ of the Mysore Agricultural and Experimental Union)

Vol. XXVII] **July to September 1951** **[No. 3**

(The responsibility of facts or opinions rests with the several authors of the articles)

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THE ANNUAL MEETING OF THE UNION, 1951

The two-day annual meeting of the Mysore Agricultural and Experimental Union was held at the Daly Memorial Hall, Bangalore, on 23-6-1951 and 24-6-1951.

The morning of Saturday the 23rd was devoted to the opening of the Conference by Sri. K. Hanumanthiah, B.A., LL.B., M.P., President, Mysore Pradesh Congress Committee. The Minister for Agriculture presided.

The function began at 10-35 a.m. with a welcome speech by Sri. B. Choodegowda, Vice-President of the Union, in which he traced the agricultural and horticultural aspects of Bangalore and its surroundings. The Director of Agriculture, President of the Union, in his speech, traced the history of the Union, dwelt on the present-day crisis in food production and said that revolutionary changes were necessary in the method of agriculture and it had to be brought about by a strong co-operative effort.

Sri. K. Hanumanthiah, in his opening speech, pleaded that the respectability of the agricultural profession must be considerably bettered and that the occupation must be made remunerative. He referred to the suggestion made by the National Congress to improve agriculture. He also urged that agriculture should be compulsorily taught in educational institutions and that the State should guarantee minimum prices to agricultural products.

The Minister for Agriculture said that some of the recommendations of the Congress were being implemented, that there was no difference of opinion in regard to assuring a fair price to agriculturists and that from 1st of July controls were being relaxed in informally rationed areas.

The opening function terminated with a vote of thanks by Sri. M. Vasudevamurthy, Secretary of the Union.

A subject committee was elected consisting of the following persons to scrutinise subjects sent by members for discussion at the annual meeting : Director of Agriculture, Deputy-Director of Agriculture, Sri. B. Choodegowda, Sri. Solur Siddappa, Sri. B. V. Venkatacharya, Sri. P. Nagesha Rao and the Secretary.

A managing committee meeting of the Union was held at 12-30, the main point of reference being election of Honarary Members : (1) Sri. A. K. Yegnanarayana Iyer, M.A., N.D.A., N.D.D., Dip. in Agri., (2) Dr. B. Narasimha Iyengar, B.A., Ph.D., (3) Sri. Santhehally

Venkataswami Gowda, Malur, and (4) Sri. Krishna Iyengar, B.A., Inamdar, Oorgahally.

The evening commencing from 2 p.m. was occupied by the symposium, the heading under which it was arranged being 'Soil Management and Increased Crop Production with Reference to Self-sufficiency'. Papers were read and talks given in the following order interspersed with discussions.

'Role of Improved Crops in Increased Crop Production'.
(Dr. L. S. Doraswamy, M.Sc., Ph.D., Economic Botanist).

'Plant Protection—Diseases'.
(Sri. S. V. Venkatarayan, B.A., Plant Pathologist).

'Plant Protection—Insects'.
(Dr. Puttarudraiah, M.Sc., Ph.D., Senior Assistant Entomologist).

'Fertilising the Soil I'.
(Dr. B. T. Narayanan, B.A., Ph.D., D.I.C., Deputy-Director of Agriculture).

'Fertilising the Soil II'.
(Dr. S. V. Govindarajan, B.A., Ph.D., D.I.C., Agricultural Chemist).

'Soil Conservation'.
(Sri. B. Rudramurthy, M.Sc., M.S. (Iowa), Sr. Assistant Director of Agriculture).

'Grow More Food Problem'.
(Sri. Mahalal Madappa).

The main points were summed up by the Director of Agriculture, who presided.

A film on the evolution of the Ferguson Tractor 'Co-operating with the Forces of Nature', was exhibited by Messrs. Ferguson Company.

The General Body Meeting of the Union was held at the Daly Memorial Hall on the morning of 24-6-1951 commencing at 8 a.m. Eighty-two members were present representing all the districts. Sri. Kalpanahally Shivappa had written to say that he was not able to attend this meeting.

The Annual Report along with audited Statement of Accounts was presented by Sri. P. Nagesha Rao, Honorary Joint Secretary of the Union. Statements of Account and the Estimated Budget are given below.

STATEMENT OF RECEIPT AND PAYMENT FOR THE YEAR 1950-51

RECEIPTS

			Rs.	A.	P.
Opening Balance (Cash on hand and Cash at Bank)			795	1	2
Admission fees	..	..	1,512	0	0
Membership fee					
Arrears	50 9 0				
Advances	1,534 0 0				
Current	4,124,10 0				
			5,709	3	0
Subscription	..	..	41	0	0
Life Membership fee	..	..	2,650	0	0
Govt. Subvention	..	..	1,000	0	0
Field-day collection	..	..	66	0	0
Suspense Account	..	..	61	0	0
Reprints amount collected	..	..	8	12	0
Interest on Fixed Deposits	..	..	56	0	0
Advertisement Charges	..	..	95	0	0
TOTAL	..	..	11,994	0	2

PAYMENTS

			Rs.	A.	P.
Establishment	..	..	2,405	3	0
By Payment to Govt. Road Transport			355	5	0
Printing of Journals	..	..	883	0	0
Postal Stamps	..	..	533	12	0
Stationery	..	..	164	13	6
Audit fee	..	..	40	0	0
Contingency	..	..	103	3	9
Placed in Fixed Deposit	..	..	3,200	0	0
By Payment to Regional Committees	..	..	378	2	6
Subscriptions (for papers)	..	..	56	0	0
Miscellaneous	..	..	73	2	0
Suspense Account adjusted	..	..	61	0	0
Payment to Bangalore Press	..	..	2,866	1	9
TOTAL			11,119	11	6
Closing Balance :					
Cash on hand	143 1 0				
Cash at Bank	731 3 8				
			874	4	8
TOTAL			11,994	0	2

Bangalore,
Dated : 18-6-1951.

Examined and found correct

(SD.) S. A. GANGADHARA SASTRY,
Certified Auditor.

STATEMENT OF INCOME AND EXPENDITURE FOR 1950-51

EXPENDITURE

		Rs.	A.	P.
Establishment charges				
(*a*) Paid in 1950-51	2,405 3 0			
(*b*) *Less* of last year	237 0 0			
	2,168 3 0			
(*c*) *Add* outstanding for 1950-51	189 0 0			
		2,357	3	0
Printing		883	0	0
Stationery		164	13	6
Postage		533	8	6
Contingency		103	3	9
Subscription to papers		56	0	0
Regional Committees		378	2	6
Audit fee		40	0	0
Miscellaneous		73	2	0
Depreciation on Furniture		18	0	0
Dues under Reprints written off		44	13	0
Excess of Income over Expenditure		985	8	0
TOTAL		5,637	6	3

INCOME

			Rs.	A.	P.
Membership fee					
(*a*) Collected in 1950-51	4,124 10 0				
(*b*) Advances received in previous years adjusted	270 0 0				
			4,394	10	0
Subscriptions					
(*a*) Collected in 1950-51	41 0 0				
(*b*) Advances received in previous years adjusted now	2 12 3				
			43	12	3
Advertisements					
(*a*) Received in 1950-51	95 0 0				
(*b*) *Less* of previous year	18 0 0				
			77	0	0
Subvention from Government			1,000	0	0
Interest on Fixed Deposits			56	0	0
Annual Field-day Collections			66	0	0
TOTAL			5,637	6	3

Examined and found correct

(SD.) S. A. GANGADHARA SASTRY,
Certified Auditor.

Bangalore,
Dated : 18-6-1951.

BALANCE SHEET AS ON 31-3-1951

LIABILITIES

			Rs.	A.	P.
1. Fund as per last Balance Sheet		..	1,253	10	9
2. Admission fee	..	..	6,106	0	0
3. Life membership fee	..	..	3,650	0	0
4. Bangalore Press	..	..	3,000	0	0
5. Establishment charges	..	..	189	0	0
6. Affiliated Association fee as per last B/S		..	162	8	0
7. Suspense as per last Balance Sheet		..	249	1	0
8. Membership fee received in advance		..	1,534	0	0
9. Expenditure :					
As per last B/S	1,496 0 8				
Excess of 1950-51	985 8 0				
		..	2,481	8	8
TOTAL			18,625	12	5

ASSETS

			Rs.	A.	P.
Membership fee due to end of 31-3-1950					
As per last Balance Sheet	12,327 4 0				
Less recovered in 1950-51	50 9 0				
			12,276	11	0
Subscriptions due as per last Balance Sheet		..	405	1	6
Affiliated Association fee due as per last B/S			50	0	0
Dues under Reprints		..	28	7	0
Library	..	..	839	13	6
Furniture : As per last B/S.	168 9 6				
Less depreciation	18 0 3				
			150	9	3
Fixed Deposit in State Huzur Treasury		..	4,000	0	0
Cash in Govt. Savings Bank		..	731	3	8
Postage Stamps on hand	..	..	0	13	6
Cash on hand	..	..	143	1	0
TOTAL			18,625	12	5

I have examined the above Balance Sheet with the books and vouchers produced to me and have obtained all the information and explanations required. In my opinion, such Balance Sheet has been drawn up correctly and exhibits a true and correct view of the state of affairs of the Union as on 31-3-1951, according to the best of my information and the explanations furnished and as shown by the books of the Union and also the accompanying report of date.

Bangalore,
Dated : 18-6-1951.

(SD.) S. A. GANGADHARA SASTRY,
Certified Auditor.

BUDGET

Actual for the year 1950-51				Estimate for the year 1951-52			
	Rs.	A.	P.	Receipts	Rs.	A.	P.
Opening Balance	795	1	2				
Admission fee	1,512	0	0	..	6,000	0	0
Membership fee	5,709	3	0		—		
Subscription	41	0	0	..	100	0	0
Advertisement charges	95	0	0	..	—		
Life Membership fee	2,650	0	0	..	—		
Field-day collections	66	0	0	..	—		
Interest on Fixed Deposits	56	0	0	..	—		
Suspence Account	61	0	0	..	—		
Reprints amounts received	8	12	0	..	—		
Govt. Subvention	1,000	0	0	..	1,000	0	0
Total ..	11,994	0	2	Total ..	7,100	0	0
	Rs.	A.	P.	Expenditure	Rs.	A.	P.
Establishment	2,405	3	0	..	2,400	0	0
Press	2,866	1	9	..	2,500	0	0
Printing of Journals	883	0	0	..	800	0	0
Postal Stamps	533	12	0	..	75	0	0
Subscription for papers	56	0	0	..	200	0	0
Stationery	164	13	6	..	75	0	0
Audit fee	40	0	0	..	150	0	0
Contingency	103	3	9	..	100	0	0
Miscellaneous Acconnt	73	2	0	..	700	0	0
Regional Committees	378	2	6		—		
Suspense account adjusted	61	0	0				
Fixed Deposit	3,200	0	0				
Road Transport	355	5	0				
Total ..	11,119	11	6	Total ..	7,000	0	0

N.B.—Government help has to be sought to pay the dues of Bangalore Press.

M. Vasudevamurty,
Secretary.

Amendments to Rules and Regulations of which due notice had been given were then taken up.

It was resolved that in accordance with elections already made in the districts, the following nine representatives be declared elected to the Managing Committee, along with the *ex-officio* members.

(1) Sri. Solur Siddappa Magadi, Bangalore District.
(2) Sri. B. V. Venkatacharya, Mandya District.
(3) Sri. Harisarvothama Rao, Yelandur, Mysore District.
(4) Sri. R. S. Subbarao, Belur, Hassan District.
(5) Sri. Annappa Setty, Chikmagalur, Chikmagalur District.
(6) Sri. Hanumantha Reddy, Shikaripur, Shimoga District.
(7) Sri. Kalpanahally Shivappa, Davangere, Chitaldrug District.
(8) Sri. Woddagallappa, Tiptur, Tumkur District.
(9) Sri. H. A. Govinda Rao, Malur, Kolar District.

It was resolved to request the Circle Offices to have General Body Meetings of members in their districts held to elect one other representative each, as early as possible.

In the place of seven members now absent from the Editorial Committee, Sri. V. Krishnamurthy, transferred from Agricultural Department, Sri. P. H. Rama Reddy, Principal, Agricultural College (Retired), Sri. S. V. Sharma, Paddy Research Officer (Retired), Sri. K. Nanjappa, Superintendent, Government Gardens (Resigned), Sri. B. Hutchegowda, Sri. M. R. Lakshminarayana Rao and Sri. R. Narasimhiah, it was resolved to take.

Sri. Gopal Murthy, Agricultural Engineer.
Sri. Mallaraja Urs, Principal, Agricultural College, Hebbal.
Sri. Srinivasa Murthy, Paddy Research Officer.
Sri. B. Rudramurthy, Senior Assistant Director of Agriculture.
Sri. Harisarvothama Rao.
Sri. E. S. Venkatesha Gupta.
Sri. Solur Siddappa.
Sri. M. Seetharamaiah, and
Sri. Veerasanjeeve Gowda.

Sri. R. Devarakondappa of Anekal was elected Vice-President of the Union for 1951-52.

Sri. S. Gangadhara Sastry was appointed Auditor, enhancing his remuneration from Rs. 40 to Rs. 50.

Resolutions were passed in respect of about 28 subjects as arranged by the Subject Committee.

Assembly was held in the afternoon commencing at 2-30 p.m. at the Daly Memorial Hall. The Hon'ble Minister for Agriculture presided.

It commenced with a prayer by one of the students of the co-operative training class.

The Director of Agriculture, in his speech, referred to the Visual Instruction Course of the Department and its Extension Service and also pleaded for an enhancement of monitary help to the Union.

The Vice-President in his welcome speech referred to the difficulties of the ryots and the backwardness of agriculture. He referred to attempts being made for gathering more members for the Union and detailed the headings under which help was needed by the Union.

The Honorary Joint Secretary, Sri. P. Nagesha Rao, read the brief Report of the Union for 1950-51.

The Secretary of the Union, Sri. M. Vasudevamurthy, read a note on the Regional Committees of the Union, its Kannada and English Journals and the Young Farmers' Clubs that were in formation.

The Hon'ble Minister distributed the club badges to boys who had come for the occasion from Ardeshahally, Venkatagirikote and Tyamagondlu. Sri. M. Seetharamaiah of Ardeshahally explained the club idea while introducing his boys.

Sri. Harisarvothama Rao and other members placed before the Hon'ble Minister the subjects that were marked for being brought up for consideration at the assembly.

The Hon'ble Minister during his address called upon the agriculturists to take an intelligent interest in their occupation to solve the food crisis. Regarding prices of foodstuffs, he said that present prices were fixed by the Central Government by taking into consideration considerable details and it is better they continue for some time. The question of getting together the Agricultural and Horticultural Departments, he said, required careful examination. Credit facilities to ryots, he said, ought to be solved by the Co-operative Apex Bank to a great extent. There was a great need at present, he said, to co-ordinate the activities of several Departments for the benefit of the ryots. Regarding a site and building for the Union, the Hon'ble Minister suggested that the Union may try to build up a fund and that its requirements would be considered with sympathy.

Sri. P. Nagesha Rao proposed a vote of thanks.

The meeting terminated with the National Anthem sung in chorus by the students of the co-operative training class.

M. V.

CULTIVATION OF CASSAVA AND PREPARATION OF ITS PRODUCTS

CASSAVA=TAPIOCA=MANIOC

By H. A. Govinda Rao

History and Geographical Distribution

According to authorities the Cassava was known as a cultivated plant to the natives of Brazil, Guiana and South Mexico before the discovery of America. It is extensively grown in the following countries :— Brazil, Guiana, Peru, Jamaica, Mozambique, Madagascar, Malacca, Java, Philippines, Ceylon and Travancore-Cochin. The cultivation of this plant is gradually extending to the western districts of Madras and Bombay including Salem and Coimbatore. Its cultivation in Mysore State is very sparse and stray plants are found to be growing here and there. Tapioca has become one of the staple crops of Travancore. Mr. Gregory, Special Officer, West Bengal, says (May, 1950), that Tapioca in one form or other has gone into the daily diet of sixty lakhs of rice-eating people of Travancore for the past seventy-five to hundred years.

The Cassava Plant.—It is essentially a tropical plant, belonging to the natural order Euphorbiaceæ (milk weed family). No uncultivated prototype of cassava plant has yet been found. It is said there are 60 to 75 varieties of cassava plant. The two chief groups are the bitter cassava and the sweet cassava. It is thought more probable that the many varieties which now exist have been developed by centuries of cultivation under widely different conditions and that all the present cultivated varieties belong to a single species. Generally the cassava is propagated by stems; but new varieties are produced through seed propagation. Many seedling varieties have been found to be good yielders. The two chief varieties that are extensively cultivated are *Manihot utilissima* (Pohl) and *Manihot palmata*, var. *aipi*, the bitter and sweet varieties respectively. Cassava is called by several names in various countries. In English it is Cassava, Manioc or Tapioca. In Tamil, it is *Maravalli Kalungu*. In Malayalam, it is *Marachini Kalangu*; and in Kannada, it is *Maragenasu* or *Buraga genasu*. In Telugu, it is *Karra, Buraga Genasu*.

The cassava plant is a perennial shrub which, if allowed to grow indefinitely, reaches the size of a small tree. At the age of about a year, when it is usually harvested it is from 6 to 9 feet high. The stem which varies in colour from pale or dirty white to brown is marked

by numerous internodes formed by the scars left by the fallen leaves. The leaves are palmate, pale to dark green in colour with about 5 to 9 lobes. There is a variety used for ornamental purposes, the leaves of which have yellowish white areas at the centre of the lobes; another variety is very conspicuous because of its curly leaves. The petiole varies from pale white to pink in colour.

The bitter or poisonous variety contains the deadly poison prussic (hydrocyanic) acid in its juice. The poison is highly volatile and is easily dissipated by moderate heating, so that when the roots have been cooked they may be eaten with perfect safety.

It was found in Trinidad, British West Indies, that in the sweet cassava, the percentage of hydrocyanic acid in the bark of the root was from 0·014 to 0·042 and in the edible portion from 0·003 to 0·015. In the bitter cassava the variation was from 0·012 to 0·056 per cent. in the bark and from 0·013 to 0·037 per cent. in the edible portion. The bitter variety is more commonly cultivated in the tropics than the sweet variety as it produces a larger crop of tubers. It has another advantage that it is never attacked by beetles (weevils). To the uninitiated it would not be easy to identify the poisonous variety from the sweet except by tasting the broken root. One is sweet like almonds and the other bitter and repulsive. Both varieties yield an abundance of nutritious and wholesome food.

The cultivation is extremely cheap and simple and it is a matter for regret that cassava that thrives luxuriently in all tropical countries is not grown on a systematic and large scale in Mysore. The cost of 'seed', unlike potato, is practically nothing. Being a drought-resistant plant, the cost of irrigation is very little. Chemical analysis does not at all support the view that cassava exhausts the soil. The total ash in the roots is commonly less than 2% of the dry weight and the nitrogen hardly more than 0·5%. Cassava does use nitrogen in the formation of hydrocyanic acid, beside in the ways common to most plants, and may therefore exhaust this food disproportionately. This can be avoided by raising a leguminous crop with the cassava alternating with it. In Brazil it is said that of all the crops, cassava is the one that gives the best return and the least trouble. Robert Thomson says, "one man can cultivate 6 acres of the plant, the yield from which amounts to 60 tons of tubers per annum at a cost of 10 shillings per ton—nearly 19 lb. of precious article of food at a cost of one penny. Accordingly, one man cultivates sufficient to support 100 persons for a year". Cassava comes nearer furnishing a more universally profitable crop than any other which can be grown on equally large areas. It can be utilised in more ways, can be sold in more different forms, can be more cheaply converted into staple and finished products and can be produced for a

smaller part of its selling price than any other crop. Cassava root is fed to horses, milch cows, hogs and poultry, all of which relish and thrive upon it. It appears that cassava is to-day the cheapest known source of starch costing at present market values of raw materials only about one-fourth as much as its competitor. Several varieties of articles of food could be prepared out of cassava—such as bread, biscuits, soji, sago meal, chips and flour.

There are different varieties of cassava some of which form tubers in six months and others in the course of nine to twelve months.

Soil and Climate.—Cassava thrives under various conditions of climate and types of soils; it is a very successful drought-resisting crop. When once provided with sufficient moisture to start with, it can thrive under many adversities, but heavy sticky soil subject to waterlogging is quite unsuitable. Well drained porous loamy soils mixed with sand, four to six inches deep are considered to be well suited. Well drained uplands or slopes of hills of *malnad,* suitable for the growth of coffee, present good scope for its systematic cultivation. In virgin red loamy soils the crop yields very heavily. Drainage is a very essential condition for the success of all crops. This is particularly true of a root crop like cassava. Land which would not admit of free drainage should not be selected for the cultivation. Heavy black or barren clay soils are unfitted to this crop. Soils excessively rich in humus should also be avoided as they produce an excessive vegetative growth of tops with small and watery roots.

The plant does well in a warm, moist climate and attempts made to acclimatize outside the sub-tropical belts have failed. According to certain authorities this crop thrives profitably up to an elevation of 3,500 feet above sea level.

Cultivation.—If a farmer expects to grow cassava on a large scale profitably, he will have to do it in a business-like way, use the high yielding varieties, prepare his land properly and use good cuttings. Cassava plant is commonly propagated by cuttings. The roots which are the only valuable portion of the plant grow in clusters from one end of the seed canes planted. Planting is done in the beginning of the monsoon rains. The ground should be ploughed or dug up thoroughly with *mumties,* followed by harrowing to level the surface. Cowdung manure, three to four cart-loads or more may be used per acre.

Setts for Planting.—The crop is propagated by planting the stem. Green stems having very close leaf scars, hard and less pithy and, as a consequence, least liable to white ant attack, are to be selected. The setts are to be selected from the middle portion of the sound and mature stems or branches. Such stems should be one to one-and-a-half inches thick. The woody parts near the base and the tender ends of the

branches should not be used. Cuttings 6" to 9" long with 4 to 6 nodes would suffice ; 4 to 5 such cuttings can be obtained from each stalk of stem or branches. The bottom ends which grow into the ground are dipped into ashes before they are planted. These cuttings are planted in different ways ; there are three systems of planting generally, namely, (*a*) ridge, (*b*) mound, and (*c*) flat.

(*a*) *Ridge.*—In this system the ground is ploughed three or four times, the turf and weeds are collected and heaped in rows three feet apart. From between the rows, earth is taken and thrown on either side, covering the turf so as to form ridges about one to one-and-a-half foot high, leaving a trench just a foot wide in the middle. On the crest of the ridges the setts are planted.

(*b*) Mounds.—Ridges are formed as above but narrow cross channels are made separating the long ridges into little mounds. Each of these little mounds receives a sett.

(*c*) Flat.—In this system the ground is well dug with *mumties*. First a furrow is made close to the boundary bund and leaves are applied along the furrow. The first furrow is then covered with earth taken out for making the second furrow and this latter is covered with earth from the third furrow. Thus the whole field is worked up. Along the rows supplied with leaves as stated above setts are planted. The flat system is the best ; the heaviest yield is obtained by this system.

In hilly country, pits one foot cube are made three to four feet apart and the setts are planted in them. The distance between the plantings depends upon the nature of the soil, the intensity of cultivation, the method of irrigation, etc. In some countries, setts are planted at three feet by three feet, or three feet by two feet distances. Poor soils allow closer planting than rich ones. The stems are laid either in a slanting position making an angle of 45° with the surface of the soil or it may be planted in a vertical position. The sticks or stems are covered lightly with soil, paddy straw or dried leaves, leaving only an inch or an inch-and-a-half of top uncovered. Care should be taken to see that stems are not planted upside down.

The results of experiments and experience in Java suggest the following recommendations in plantings. "After removing the young top portion of the stem which is not good to use as planting material, the remaining part may be cut into pieces of 8 to 10 inches long. There is no advantage gained in using longer cuttings. The stems are cut into pieces only shortly before planting. If they are to be kept for a fairly long time, the cut surfaces of the top and bottom of the bundles are coated with tar and the stems are preserved in bundles standing in a dry, dark and cool place without being cut into planting pieces. When they are to be planted, the bundles are transported to

the field and sawed into pieces of the desired length. Pieces prepared more than two days before planting should not be used. In sawing care is taken not to cause splitting of the top end of the sticks. Sticks with forked tops or developed vegetative buds should not be planted.

Mr. R. Krishnamurthy, Agricultural Demonstrator, Ponneri District, describes the following method adopted in and around Ponneri : Full length shoots immediately after harvest are planted in a cluster called 'Podies' which are channels two feet wide, three feet deep and ten feet long where one-and-a-half cartloads of shoots are placed vertically and covered with earth. If there is sufficient moisture in the soil, no irrigation is given, otherwise, it is moistened with water. The 'Podi' is said to be ripe for seed material usually after 10 or 12 days when leaf buds just begin to put in their appearance. The latex in the shoots at this stage will be at a maximum. Each shoot is cut into 9-inch long setts and planted. Usually a 'Podi' will provide sufficient material to plant an acre. On no account should a *podi* be allowed to mature for more than a fortnight or till the leaf buds change into leaves as it then indicates that rooting has taken place at the bottom. Setts from such over-mature shoots make poor seed material. The latex content in over-mature shoots of *podies* is considerably less and shoots also become pithy. *Podies* should be made near the land where planting is to be done and not near growing areas.

Mr. Carr, a member of the Agricultural Society of Trinidad, and a prominent estate owner, has furnished the following note as to a method he discovered of shortening by about one half the time for the ripening of cassava tubers.

"Hitherto the way of planting cassava plant was in short portions of the stock from 6 to 9 inches long, but purely by an accident it has been found that the whole length of the stock of the cassava plant if planted, the tubers ripen and are fit to eat in 4½ months, against the old method which involves at least 8 months. The manner of planting is simply to insert the lower end of the stock into the ground not more than two or three inches deep and, in order to secure the growing plant against the force of the wind, if in an exposed position, the plant should be tied to a stake. Planting is usually done in the month of May. In new lands as high as 12 to 15 tons of fresh tubers can be obtained, whereas in old practically worn out lands, unless a liberal supply of manure is allowed not more than 6 to 8 tons of tubers can be depended upon."

Time of Planting.—The time of planting depends upon the local conditions. A certain amount of moisture is necessary to start growth. The best time for planting is just before the monsoon rains when the soil is moistened by early showers. For wet soils the planting may

be as late as September. But for laterite soils the planting should be finished by June or middle of July. Early planting in May under artificial conditions of irrigation to start growth is said to encourage vigorous growth of plant and produce heavy yield. It should be noted that the planting is not to be done when there is too much rain, as should the soil be waterlogged when the cuttings are put down, they are apt to decay. In uneven ground the roots become irregular. A stout and symmetrical root, having less surface in proportion to its bulk, will contain the least poison and the highest percentage of starch, while an irregular root or a very long one, will be comparatively bitter and weak in starch.

Intercultivation.—Cultivation begins when the plants are about one to one-and-a-half foot high. Every month thereafter for three months weeding should be done. When the plants have grown about two-and-a-half feet high, hilling should be done gradually. Hoeing between the rows is done once a week in the first two months and once a fortnight the next four months. Irrigation is given once a week, when there are no rains. After hilling the plants may be left unweeded, for a dense shade will have been formed by the leaves above the ground preventing to a large extent the growth of weeds. Further any disturbance of the soil near the base of the plants may seriously disturb the development of the storage roots. When the plant attains the height of about 3 feet, the terminal buds should be nipped. This ensures higher yield. Nipping can be done a second or third time also with good results.

Manuring.—In virgin lands much manuring is not necessary for the first trial. For the next trials the land should be well manured. A handful of mixture of well rotted cattle manure and ashes is to be applied to each sett either at the time of planting or six weeks after the time of hoeing and weeding. The best manure compost at the rate of one handful per plant has given excellent results.

Harvest and Yield.—The plants should be ready for lifting after 8 to 10 months according to the variety grown. When the plants begin to shed leaves and the flowers are formed, the tubers are considered to be ready for lifting. A couple of plants may be lifted to see the stage of maturity. Just before the actual harvesting commences, the field is irrigated once. It is advisable to harvest early, *i.e.,* when the crop is 6 to 8 months old for marketing the crop as a vegetable. But for making sago or flour, or chips it is better to allow the crop to stand for full eleven or twelve months. Even where the plants are fully twelve months old, the tubers can be kept on in the ground for another six months without damage. This is a favourable point for the sago manufacturer as it gives him time to prolong his working

period. For making meal or manufacturing starch, the roots cannot be gathered until they are well beyond the best age for direct use as human food; thus, in Africa they are eaten fresh, when about 9 months old, and not used until 12 to 14 months old for making meal. In some parts of Philippines the roots are said to be grated and eaten when three years or more old. The best time to harvest is to be determined locally. As between 12 and 18 months of age, the general result is that for the sake of greater yield it is decidedly better to have the plants a year-and-a-half. The percentage of starch begins to decrease before the plants are twelve months old, but the total amount continues to increase rapidly and the slightly increased woodiness does not seriously interfere with its extraction.

It will be necessary at times to estimate the yield of a standing cassava field at a given time either to have an idea of its yield for purposes of sale or at intervals of one month to determine if the maximum yield is already obtainable. To estimate the yield of a field it is recommended that every tenth row be sampled, harvesting plants from every 10 hills in each tenth row and determining the yield. From the yield obtained from the number of hills harvested, the yield of the total number of hills in the field may be estimated. When the yield is no longer increasing the field is at the proper age to harvest.

Harvesting.—Actual harvesting operation is done by a man gripping the bottom end of the shoot with both hands firmly with legs planted squarely, and pulling out. If portions of roots remain lodged in the soil, they are dug out with the *mumti*. The pulled out tubers are cleaned, steeped in mud and carted either to the market or to the factory as the case may be. The steeping in the mud is necessary for preserving its freshness. By this means the tubers can be kept fresh for four days. Twenty labourers can pull out and clean an acre's product, *i.e.*, about 4 tons. Unlike other root crops, cassava requires more careful attention in harvesting. The simplest lifter is a straight wooden stick eight to ten feet long, strong enough so that it will not break, which is used as a lever. The fulcrum end rests on the ground and is provided on the underside with an old spade blade or some other flat body to prevent its sinking in. Near the fulcrum end is fastened a hook or other grappling device. By lifting the long arm of the lever and shaking the plant is pulled out of the ground reasonably free from adhering soil. If the field permits ploughing, a furrow is run alongside of each row, making the roots to pull up more easily and with less breaking.

Yield.—A well developed plant produces 6 to 8 tubers, some even 10 to 12 according to treatment and variety. On an average three to four edible tubers can be obtained from a single plant 12 months

old. If cuttings are planted three feet apart there will be 4,840 or 5,000 plants per acre. The roots which are the only valuable portion of the plant, grow in clusters from one end of the seed canes planted. Clusters of roots ordinarily weigh from 5 to 10 lb. though they often reach 20 to 30 lbs. each. We can conveniently take 500 maunds of 28 lbs. as the average annual yield per acre. It is possible to get two tons of food per acre of cassava taking 33% as its edible portion. This is a much higher yield than that of any foodgrain per acre. The average production of crop per acre in Philippine Islands is 8·675 tons and the cost of production is only 3 annas per maund of 28 lb.

The Several Uses of the Tubers

(*a*) The roots must be washed and skin removed. They should be washed a second time before being used for any purpose. The skinned and washed roots may be cut into chips and dried in the sun or stored or exported to other countries. These dried chips are called "Galpek" in Malaya and large quantities have been exported from Java and Philippine Islands to Europe for a long time, where they are used for the manufacture of industrial alcohol and starch. United States and Japan have also been importing *galpek* from Java in recent years.

(*b*) The skinned and washed roots are boiled and eaten with salt, but it would be advisable to drain off the water in which it is boiled. The second method is to peel it, then grate into cassava meal, then cook by steaming; the third is to eat the boiled, grated meal with grated cocoanut.

(*c*) The dried cassava meal or chopped roots may be ground into fine powder and sifted. This flour may be used in the preparation of various foods, preferably in combination with wheat flour.

(*d*) The roots before they are fully mature, *i.e.*, when they are about 8 to 9 months old, can be used as a vegetable like potato or raw plantain.

Other uses of Cassava : Starch, Sago, Arrowroot, Soji, etc.

Manufacture of Starch.—The first step is to wash the roots clean. The washing can be done by hand or by mechanical washer. The bark and cortex which contain no starch are removed. The starch in the roots is contained in the cells of the pith. The starch grains are minute, smaller than those of the potato. The cell walls must be broken to release the starch. The walls are broken by decay or by scraping, rasping or crushing the roots. The Chinese method in the Straits Settlements is to wash the roots, peel them, wash them again, grind or crush between rollers, strain out the fibrous parts of the pulp with a sieve which permits the starch to pass through with

water, let the starch settle, draw off the water, and wash until clean and dry. To ensure the quality of the starch an abundance of clean water is essential. The pulp needs from 2 to as many as 8 washings. The completeness with which the starch is removed depends upon how completely all the cells are broken. The cleansed roots, milled and ground into a pulp, are transferred into large copper cylinders tinned inside and perforated at the bottom with numerous minute orifices. Within these cylinders wooden paddles are made to revolve mechanically with great velocity, at the same time that a stream of water is admitted into them from above. The paddle arms beat out the fecula from the fibre and the parenchyma of the pulp and discharge it in the form of a milk through the perforated bottom of the cylinder. This starchy water runs along the pipes and then through a strainer into large reservoirs, where after the fecula has subsided, the supernatant liquor is drawn off and fresh water let in; the whole is agitated and left again to repose. The starchy material thus obtained is dried on trays in the sun. If the peeled roots are not to be grated at once, they should be submerged in water to prevent the formation of a dark coating on the peeled material. The grated material is called cassava meal. The starch should be dried thoroughly and uniformly. When spread quarter to half an inch thick on the drying container, the wet starch will dry in from 12 to 36 hours exposure to the sun depending upon intensity of the sunlight. In the process of drying it is necessary to turn over the starch occasionally. The dried starch is in the form of lumps and before it is placed into the market it is prepared by grinding. The starch should be kept in dry containers or in dry rooms (*see* N. B. Mendiola's article).

Manufacture of Sago : (as a cottage industry)

Sago is a manufactured product of cassava and its manufacture started particularly in Salem, Madras, where there are twenty small factories run on a cottage industry basis. About 1,600 maunds of sago are produced per day in Salem Town alone. In and around Salem 50,000 people are employed in this sago manufacturing industry. Robust, well-developed, freshly pulled out tubers are brought to the factory site, the outer skin is peeled off, either with hand or with a knife. The peeled tubers are scraped into uniform shavings by means of hand-driven scraping machine. The scraping machine consists of a horizontal spindle with sharp small curved spikes or projections over its entire surface.

In the middle of the rotary there is a two-inch groove. The rotary is connected to a cranked wheel, by means of circular rope which passes round the wheel and along the groove of the rotary

like a belt drive. By turning the wheel the rotary begins to rotate on its own axle. While it is rotating the tubers are gently pressed against its surface and the shavings that fall off are collected in a tray placed underneath. The shavings so collected are taken to a cement tub and mixed with water. They are then transferred to a cloth and strained. The outflowing liquid is collected in another cement tub with plugged out holes at different levels. After two or three hours of standing, a floury white mass settles down and the supernatant water is drawn out by unplugging one of the outlets. The white powdery residue is dried for an hour or two and sieved by means of special superfine meshed sieve till all the fine flour is separated. The coarse flour is mixed with the next charge in the first tub. The sieved fine flour is placed on a clean dry white cloth and oscillated gently till it forms into uniform small pellets. These are often graded by means of a suitable sieve, bagged and sold as sago. Coalesced pellets and the coarse grain are marketed as Tapioca Rice at a slightly cheaper price.

The pulp left over after straining the starchy liquid is dried and fed to cattle or made into fine flour and sold at about Re. 1 per maund of 25 lb. for making (*Kumkum*) *saffran* or as a substitute for fullers' earth or kieselguhr for making face powder of a cheaper quality. One ton of tubers give one-sixth of a ton of sago. During the war period, a maund used to sell at about Rs. 20 and one acre's produce used to bring in a gross return of Rs. 1,200. The sago so manufactured keeps its quality unspoiled for nearly a year.

Arrowroot, Flour and Soji

The above articles are manufactured from the cassava roots by the following process. The roots are first washed and then put into a big vat and allowed to stay for six or seven hours. After this the thick skin of the tuber is easily peeled off and the kernel is then cut into small pieces and again washed and made into a pulp in a *dhenki* or some wooden receptacle by hammering with a long thick wooden bar. The pulp is put into a strong cloth and the water squeezed out (just as in a cheese press). The cloth with the pulp is then put in another vat in clean water and the pulp stirred well (inside the cloth submerged in water with the pulp). The water will gradually become milky white, when all the starch has thus been removed from the pulp, the pulp is then dried and hammered and made into powder and then sieved by a fine cloth. The finer portion which has been called here *flour* will come out and the residue in the fine cloth will resemble ordinary *soji* and can be used accordingly. Meanwhile the starch in the milky water in the vat will settle. The water can be easily decanted and the precipitate at the bottom may then be dried in the sun to

obtain what has been called here as "arrowroot" or Tapioca meal. This is also known as "Brazilian Arrowroot".

Well dried chips are ground into fine flour and used as a substitute for rice flour or ragi flour, for almost all the preparations where rice or ragi flour happens to be the main constituent. Sixteen maunds of chips give about 13½ maunds of flour. The flour keeps on unspoiled up to six months with occasional sun drying.

The Food Value of the Three Important Tubers Used

Name of the tuber	Moisture	Protein	Fat	Minerals	Fibre	Carbo-hydrates	Phos-phorus	Iron	Calcium
Potato ..	74·7	1·6	·1	·6	..	22·9	·03	·7	·01
Cassava ..	59·4	0·7	·2	1·0	..	38·7	·04	·9	·05
Sweet Potato ..	66·5	1·2	·3	1·0	..	31·0	·05	·8	·02

The average yield of raw tubers per acre can with safety be taken as 400 maunds of 28 lb. and from this quantity the following prepared products could be got.

122 maunds of sun dried chips or 102 maunds of flour or 60 maunds of sago.

The following is the result of experiment done with 54 plants in Bengal :

No. of plants	Weight of tubers			Weight of food manufactured						Total		
				Flour		Soji		Arrowroot				
54	Mds. 4	Srs. 2	Ch. 5	Srs. 10	Ch. 9	Srs. 22	Ch. 0	Srs. 7	Ch. 9	Mds. 1	Srs. 0	Ch 2
	or 324⅝ lb.									or 80¼ lb.		

Diseases and Pests

Practically, cassava is free from the attack of serious plant diseases and pests in the field. Rats are a great menace to this plant and precautions in this direction have to be taken. In lands adjoining forest areas wild pig is a great nuisance. Cattle are fond of browsing the plants and so the plants should be protected from them. A very important point in favour of this plant is its being monkey proof.

Experiments

Cassava cultivation is a new venture in Mysore State. Many an agriculturist does not know what a cassava plant is, much less does he know about its usefulness. But by reading the above notes, I hope,

an agriculturist will be inclined to grow cassava (or Tapioca) on a large scale to help himself and others in these hard days of food scarcity. No doubt, he may have got a theoretical knowledge of cassava cultivation, as a root crop, but, for practical knowledge where could he go to? There are no demonstration or experimental farms conducting detailed experiments in cassava growing anywhere in Mysore. At this stage the Government will please come to his aid by starting farms where experiments could be conducted and the farmers shown round the demonstration farms to give them the necessary instructions and information of scientific and practical problems regarding cassava cultivation. Therefore, it would be absolutely necessary to start such demonstration and experimental farms in *malnad, maidan* and *canal* areas of the State to study the following out of several problems known.

1. Collection of varieties.
2. Selection of varieties.
3. Breeding new varieties.
   Inter-breeding on the basis of yield, quality of the produce, etc.
4. Statistical experiments on manuring, varieties and soil.
5. Investigations on the length of cuttings to be used, spacing, irrigation and method of planting.
6. Reducing the period of maturity.
7. Finding out simple machinery useful for starting home industries of cassava products.
8. Finding out the best methods of intercultivation, intercropping, etc.

As cassava cultivation is a new venture in Mysore the agriculturist will do well to proceed with a scientific eye and go on collecting all data he can and publish his experiences and experimental results in journals like the *Mysore Agricultural and Experimental Union*, the *Gramabhyudaya*, etc.

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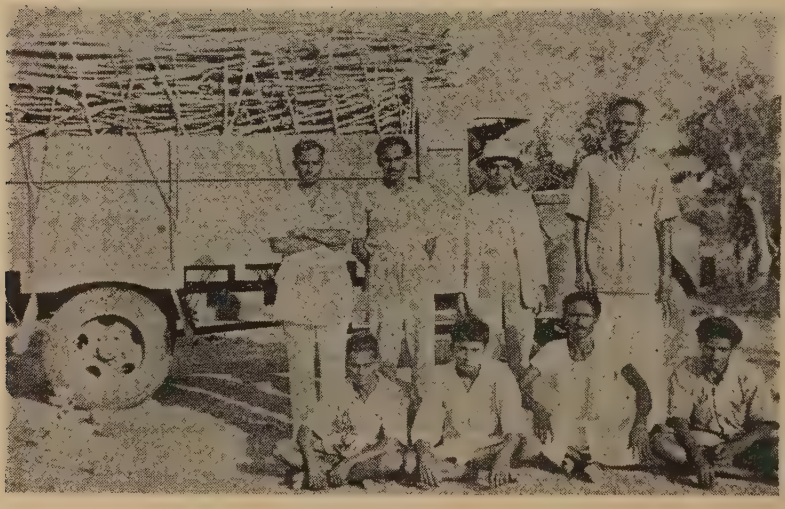
A Cassava plant growing in the back yard of the Ramakrishna Students' Home—Visveshwarapuram, Bangalore

Roots—Edible Portion of Cassava

Uprooting Tapioca in Salem



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A SHORT NOTE ON TAPIOCA

By N. Suryanarayana Rao, *Agricultural Inspector*

Tapioca is grown under a wide range of rainfall from 20 inches to 125 inches. The crop stands drought well as observed in parts of Salem. It comes up well under irrigation but not in stagnated condition of soil. It is grown in all types of soils and even on hill slopes as seen in parts of Cochin; clayey, sticky and saline soils are not suited.

Season.—Crop is generally planted during June and July and in some parts during September and October. Planting is also seen done in April and May where pre-monsoon showers are received, and in December and January in tracts where irrigation facilities exist. Generally the hot and dry months of February and March are avoided. Thus Tapioca is a crop for all seasons.

Cultivation.—The land is prepared by ploughing 3 or 4 times, either with wooden ploughs or iron ploughs. Manure is applied at 10-15 cartloads to the acre before the final ploughing. In places of heavy rainfall like Malabar, the land is ridged up 3 to 4 feet apart with contour drains 20 feet apart to take off surplus water. But in places of moderate rainfall like Salem District, the land is prepared into beds 3 to 4 yards square. Tapioca stems of the previous crop, stored in shade are used as planting material. The stems are cut into bits at the time of planting rejecting the top tender portions. A small length at the basal end, if dry, is also rejected. The setts are 4 to 6 inches in length and each stem gives 8 to 9 setts. The cuttings from the basal end are better than the cuttings from the top end. Setts are planted in various ways—slanting, vertical and horizontal. Vertical planting is supposed to be the best where rainfall is moderate and slightly slanting position is adopted where the rainfall is more than 60 to 70 inches so as to avoid direct flash of water on the tops of cuttings planted. The spacing depends upon the condition of the soil and irrigation facilities available. Three feet either way is good spacing and two and a half feet either way is suited to poor soil. With three feet spacing, 5,690 setts plant an acre and with two-and-a-half feet spacing, 7,200 setts are required. The depth of planting the setts also varies from place to place. In some parts they are planted 3 to 4 inches deep and in parts of Salem, they are planted ½ to 1 inch depth. Shallow planting is supposed to be the best for the formation of tubers. If

the crop is grown as a dry crop, planting is done with the commencement of rains and hand watering is done till the setts are established. If the crop is grown as an irrigated crop, an irrigation is given on the day of planting and two light irrigations at an interval of 4 to 5 days; no further irrigation is necessary till the close of the monsoon season. After monsoon is over, irrigations are given at intervals of 10 to 15 days and 15 to 20 irrigations are required in all for the crop till it is ready for harvest.

After Cultivation.—Hoeings are done 4 to 5 times at an interval of about a month each time. Generally two weedings are done. Earthing up is done when the crop is four months old and a second earthing up two months afterwards. Branches are pulled out leaving only two branches when the crop is weeded for the first time.

Harvesting.—The crop is harvested after the tubers are fully developed. The maturity of the crop is indicated by shedding of leaves. The plot is irrigated before harvest. The plants are pulled out with tubers in light soils and dug out in the case of heavy soils.

Yield.—An average of 4 to 5 tons of tubers are obtained in dry cultivation and irrigated crop yields 10 to 12 tons tubers. The tubers do not stand storage. They are fit for cooking for a week from the time of digging. In view of their short storage life, the tubers are lifted from the soil only as and when required. The crop can be kept on the land for about three months after maturity.

Pests and Diseases.—Tapioca is practically free from pests and diseases.

The Uses of Tapioca and Its Products

(1) The fresh tubers are used as vegetable.

(2) The tubers are peeled, sliced and boiled and made into curries of different types; or the cooked slices with salt are eaten as such.

(3) The tubers are made into slices and fried in oil to make *uppams.*

(4) The peeled skin of the tubers are fed to milch animals.

(5) Tapioca leaves are fed to bullocks, buffaloes and goats, etc., after light drying in the sun for 2 to 3 hours. Even the green leaves are also fed to animals.

Products made out of Tapioca tubers on commercial scale in Salem District are as follows.

(*a*) *Flour.*—Tapioca tubers are peeled and dried in the sun. The dry chips are made into flour by flour mills. The flour is utilised by the weavers and in cloth mills for dipping the threads to be woven.

The flour is also used for preparing *bajji, bonda,* biscuits, cakes and sweets, either mixed with Bengalgram flour or with wheat flour.

(*b*) *Soji.*—Tapioca tubers are sliced, boiled and dried. The dry slices are ground coarse in mills and sieved. The coarser particles are separated and packed in bags as soji and sold in market. From Tapioca soji *uppumavu* is prepared in hotels.

(*c*) *Starch.*—The skin of the tubers is peeled and then they are put into a power driven machine and made into pulp. The pulp so got is transferred to a cement tank containing water and stirred well. The stirred water is passed on to an other tank and allowed to settle down. After the starch settles down in the tank, the water that stands on it is drained off. The settled pasty material obtained is called 'crude starch'. The crude starch so obtained is put into a third tank, charged with fresh water and allowed there to settle. After settling of starch the water is drawn off and the starch so obtained at the bottom of the tank is put in muslin cloth for further draining of water. The white material thus got is spread out for drying. The dry starch is then packed for market.

(*d*) *Sago.*—There are very many 'Sago' factories distributed all over in Salem District. The sago is prepared from the Tapioca tubers on a commercial scale. The preparation of sago is as detailed hereunder.

First Stage.—The tubers are got from the field and the thick covering of the tubers is removed. Then they are put under water for 12 hours. They are well washed and put into grinders for making into fine powder. The grinder is a simple-toothed drum rotated by an electric motor of 10 or 12 H.P. Water is allowed through the feeder where the tubers are ground. The ground material mixed with water flows through a funnel and passed on to a platform of cloth tied over a cement tank. The women coolies standing on the sides of the cloth rub the ground material mixed with water. The finer particles of starch mixed with water drain through the cloth to the cement tank underneath and the unground portion called 'Thippi', left on the cloth, is removed. The starch mixed with water so drained to the tank is filtered twice before it is allowed to settle in the tank. The water that remains at the top is drained off and the material settled in the tank is taken out and dried in the sun to a certain percentage of moisture enough to convert the powder into granules.

Second Stage.—The dried powder is sieved in cloth and shaken vigorously so as to form granules of different sizes. The granules so formed are sieved first in 7½ sieve, then 8¾ sieve and then in 9¾ sieve. Only the sizes sieved from the last 9¾ sieve are taken and the other sizes are again powdered and remade into grains.

Third Stage.—The grains are then roasted in a furnace for about 15 minutes. The roasted materials are dried in the sun for about 6 hours. Finally, the dried grains are polished in a polisher which is also a rotating drum with teeth. Such well polished grains are packed in gunnies and made ready for market.

The unground portions called 'Thippis' which remain on the cloth are removed and sold to a class of merchants who grind them in flour mills after drying in the sun and sell in market for cooking purposes.

Outturn.—For every 5 maunds and 6 lbs. of tubers, one maund of sago rice, 85 lb. of *thippis* and 21 lb. of husk are got.

(*a*) The percentage of sago rice to tapioca tubers .. 19%
(*b*) The percentage of *Thippis* to tubers 65%
(*c*) The percentage of upper covering tubers 16%

Cost of Production and Profit

(*a*) Cost of 5 mds, 6 lbs. tubers at Rs. 2-4-0 per md. (From 5 mds. 6 lbs. of tubers, one md. sago rise and 3 mds. *thippis* are got).	Rs. 13-0-0
(*b*) Labour charges for making one md. sago rice	Rs. 1-8-0
(*c*) Electric and other charges	Rs. 6-8-0
TOTAL COST OF PRODUCTION	Rs. 21-0-0
Cost of one md. sago rice	Rs. 12-8-0
(b) *Thippis* sold to merchants at Rs. 0-2-0 per lb.	Rs. 10-4-0
TOTAL INCOME	Rs. 22-12-0

Profit is Rs. 1-12-0.

The profit may go up when there is good market for sago. 25% of the production is consumed in South India and 75% is exported to Calcutta, Poona and Bombay.

The Uses of Sago

(1) Sago gruel is an invalid food.
(2) *Payasam* might be prepared out of sago.
(3) *Kesaribhath* and other sweet dishes could be prepared.

SELECTION 1

A NOTE ON THE PRODUCTION OF SOJI, SAGO AND FLOUR FROM TAPIOCA IN MYSORE

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It is perhaps superfluous on one's part to make out a case for the production of more food in every possible form. As things stand, it will be extremely difficult, if not impossible, to provide additional quota of grains to the people. So we will have to seriously consider the possibility of production of food in other forms, which are already known and which are being used by our people.

There are three well known forms which are being freely used within the State : (1) Soji, (2) Sago and (3) Flour. All these three materials can be produced out of tapioca, and at the present time, they are being imported into the State from the neighbouring districts, particularly Malabar, Salem and Coimbatore at considerable cost. Soji is now costing 8 to 9 annas a pound, sago 9 to 12 annas a pound and flour 5 to 6 annas a pound. All these three products can be made at about half the above prices, if not less, if they can be produced within the State.

Our immediate object is to produce them on a semi-large scale in our Institute in Mysore and then to make them available to the public through any agency which the Government may determine. As the products get distributed and when people see the advantages of producing and using the products, there will naturally be further stimulus for both production and distribution. We will gladly help the Industry in every possible way.

For producing the products, we require the raw material, which, we are hoping, will be first made available to us by the Department of Agriculture. If there is a guaranteed off-take for the finished products, we have, no doubt that even private producers will soon be forthcoming in sufficiently large numbers. We also propose to utilise a part of the grounds around our Institute for immediate production. With the necessary care, the yield of tuber will be at least 4 to 5 tons per acre and we are hoping that the raw tuber will be made available to us at Rs. 80 to Rs. 90 per ton. Even then, it will be paying to the producer.

We propose producing about 400 lb. of each of the products per day. We expect that this will be only a very small part of the off-take from even the City of Mysore. We could easily increase the output if so desired, and provided the necessary quantity of tuber is made available. We require a capital of about Rs. 10,000 for setting up a production of 3 to 4 cwt. per day of each product.

We estimate that for the production of soji at the rate of 1 cwt. per day, 12 to 14 acres will have to be planted with tapioca. The corresponding acreages for sago and flour will be 15 to 18 and 10 to 12 acres respectively. If we are to produce a single product, such as soji alone, at say, 1 ton per day, we will require about 300 acres. The plantings will have to be done in different seasons so that the supply may be maintained all round the year.

The conditions in Mysore State are quite favourable for the production of the three products. The products are not controlled at the present time, but the off-take is pretty considerable. One need not be surprised, if, in course of time, when the demand increases, the Government finds it necessary to control the commodities and to distribute them to Ration Shops along with other food materials. If such a stage is reached, the production will be greatly stimulated and we will feel the shortage of food material to a less extent than we do at the present time.

The great advantage in the production of processed tuber foods lies in the fact that we can produce 3 times as much of them per acre of land as we are now able to obtain in the form of grains. Production of tubers would, therefore, offer a simple practical method of making up for the deficit of grains. The products are quite useful articles of food and scientific evidence has shown that when they form a small part of our diet (upto 25%), they do not lower the overall food value. On the contrary, the general effect is slightly better because the tuber provides certain essential minerals in which our diet—particularly the rice diet—is lacking.

Judging from the present trends, it will be very difficult to increase our rations of grains, unless we import very large quantities from other countries at considerable cost. By consuming even a few ounces per day of such subsidiary foods, we can not only meet our immediate requirement of extra bulk food, but also look forward to a time, when with larger production of such materials, we can even be independent of outside supply. With a certain amount of sympathy and understanding of the scientific effort in such fields, with the general co-operation of all concerned, it should not be difficult to reach the desired goal in the course of a few years, if not immediately. We can attain the goal even before 1951, if there is a concerted nation-wide effort along similar lines.

Mysore has taken the lead in several other fields, and the people are both enterprising and appreciative of new efforts. It is sincerely hoped that in this very important field of food supply, Mysore will again take the lead and set an example to the rest of the country.

SELECTION 2

POPULAR RECIPES OF TAPIOCA AND SWEET POTATO

1. *Tapioca Chips.*—The roots are washed clean and sliced with a vegetable slicer or a sharp knife to a thickness of ¼". The slices are washed in cold water and the water drained. Then they are sun-dried or dried in a hot air oven. These slices, when completely dried, can be used in a number of ways. These slices can be fried in oil; (*b*) can be kept for 20 minutes in hot water about 80° C. and used as a vegetable in curries.

2. *Tapioca Porridge.*—The chips can be powdered in a mortar and converted into flour. The flour can be used in making porridge.

3. *Tapioca Puttu.*—The roots are boiled well and taken out and immersed in ice cold water for two minutes. The outer stem is peeled off and shredded with a vegetable shredder. Coconut shredded similarly is then added with sugar to taste. A mild flouring can be given with a pinch of powdered cardamom seed. The mixture is pressed into jelly moulds and can be served for lunch or tea.

Tapioca Cutlets.—Tapioca, boiled and shredded, ½ lb. minced; Coriander leaves, 1 tola; Blackgram dhall, 1 heaped tea spoon; Onion, 1 palam; Ghee or any good vegetable oil 2½ palams; Maida, 2 palams; Cashew nuts, 1 palam; and Asafoetida, 1 gram.

Slice onions and cashewnuts, fry them with black gram in a little ghee. When light brown, add the shredded tapioca and stir for a minute after adding the coriander leaves. Roll the mixture into small rounds and give a dust of *maida* flour on top. Fry to light brown in ghee or oil. Persons who like eggs can have one egg beaten well and the rounds dipped in the egg before frying.

Tapioca Pakkoda.—Take all ingredients as above. Instead of *maida* use Bengalgram flour. Mix into a thick paste and fry to light brown.

Sweet Potato Chips.—Slice and wash in clean cold water. Strain and dry in the sun or in a hot air oven till brittle. Store in a closed tin. Fry when required in oil and ghee and add powdered chillies, pepper and salt to taste. The chips should be put in boiling water and allowed to simmer for 15 minutes when they would assume the shape of fresh sweet potato slices. Then cook as fried potato into *sambhar, porials, kuttu,* etc.

Sweet Potato Poli.—Boil ½ viss. sweet potato. When soft, take and peel off skin. Take 2 ollocks *maida* flour and mix with the boiled

potato into a *maida* paste or dough. Add a pinch of powdered cardamom. Roll into a circular shape. Then place in a mixture of boiled Bengalgram and jaggery ground into a paste. Cover uniformly on all sides with the sweet potato dough. Roll into a circular cake and fry over a light charcoal fire on a frying pan, after smearing it with ghee.

Sweet Potato Appalam.—Boiled sweet potato is mixed with ⅛th the weight of black gram flour, well after adding a pinch of salt to little asafoetida. The mixture is kept for 2 hours to ripen. Then small *appalams* can be rolled out and dried for frying later on. A little chilly powder is added sometimes to the dough.

Sweet Potato Podima.—Half-boiled sweet potato is shredded fine. A mixture of shredded onions, green chillies, black gram dhall and a pinch of asafoetida is taken and fried to light brown in ghee or oil. The shredded sweet potato is added and ½ a palam of green coriander leaves is added. The whole mixture is stirred for 10 minutes till it assumes a powdery form. It is served hot during dinner.

Vermicelli.—Boiled sweet potato is mixed with ¼ the weight of wheat flour into thick paste. It is then cast into vermicelli with a hand press and dried in the sun. This vermicelli can be used for *uppuma, payasam, batu,* etc.

Tapioca Uppuma.—Boiled tapioca shredded as above can be mixed with one-third quantity of semolina or broken rice and made into *uppuma.* The semolina or broken rice should be given a preliminary boiling before the shredded tapioca is added.

—By Courtesy of the Director of Agriculture, Madras.

936.51 Printed at The Bangalore Press, Bangalore City, by G. Srinivasa Rao, Superintendent, and published by M. Vasudevamurty, Secretary, Mysore Agricultural and Experimental Union, Bangalore City.